# SUPPLEMENT.


# The Mining Journal,

## RAILWAY AND COMMERCIAL GAZETTE:

**FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.**

No. 1632.—Vol. XXXVI. LONDON, SATURDAY, DECEMBER 1, 1866. {STAMPED .. SIXPENCE. {UNSTAMPED. FIVEPENCE.


## Original Correspondence.

### GAS LIGHTING, ON THE RAIL AND AT SEA.

Sir,—The subject of artificial illumination is one which has obtained a large share of attention from a very early period in the history of mankind. The desirability, if not the absolute necessity, of finding a substitute for the absent rays of the orb of day, and of the lesser light that rules the night, must have impressed itself forcibly on the minds of such people as had advanced one stage on the high road of civilisation, or imbibed even an elementary perception of the meaning of the word comfort. For many centuries, nevertheless, the modes employed for obtaining artificial light were exceedingly primitive and imperfect, and they need not here be further alluded to. The discovery and introduction of gas revolutionised the arrangements for lighting the streets and shops of large towns by night, and it is only remarkable that chemical and mechanical science did not earlier indicate the possibility of obtaining and utilising the valuable material which coal is now made to yield in such abundance.

When Dr. Clayton, in the year 1691 (*temp* William III.), first made and used inflammable gas, for the illustration of a philosophical experiment, he, probably, did not calculate upon the extended application of the invention which would subsequently take place, or imagine that it would ever be of value beyond the domain of the chemists' laboratory. Sir James Lowther and Dr. Watson at later periods drew the attention of the Royal Society to the natural generation and evolution of gas of an inflammable kind in some of our northern collieries, but their investigations ended without practical results, and it was not till the year 1792 that any really successful efforts were made to create gas from coal, and to turn it to the purpose of artificial illumination. To a sturdy mechanical engineer of Cornwall must be accorded the actual merit of accomplishing these ends. William Murdock was the name of this talented man, and it may encourage others of his class to learn that his invaluable discoveries were made during his leisure hours, in the evenings of days spent in constant and laborious exertion. Murdock succeeded, after many experiments, in lighting his house at Redruth with gas in the year named. He also constructed a lantern with a bladder of gas underneath it, and by its aid lighted himself at night across the moors when returning from work. Murdock had ample opportunities afforded him afterwards of developing his plans, and this he did under encouragement from Messrs. Boulton and Watt, of Soho, near Birmingham, in whose employment he was. The results justified his enthusiasm and their support, for in 1802, when the Peace of Amiens was consummated, when the whole country was jubilant, and when the people burnt rushlights in their windows, and called the display a "general illumination," Murdock paled the ineffectual fires of the latter by lighting most brilliantly the whole of the exterior of the Soho Manufactory with gas.

The fame of the performance travelled with all the rapidity possible in those days of pack-horses and road wagons, and thenceforth the "new light," as gas was termed, became the popular topic, and was increasingly used. It is unnecessary to trace at any greater length the history of gas lighting, so far as streets, shops, and manufactories are concerned; and we turn, therefore, to the newest phase of application—namely, to that of its employment in railway carriages, and on board steam and other vessels. One of the greatest inconveniences attending railway travelling was that of sitting, perhaps for many hours, in a carriage at night with no light save that emitted from a miserable oil lamp, and which was scarcely sufficient in power to make even "darkness visible." It is needless to descant upon this source of annoyance, because all railway travellers have had experience of it. Numerous schemes for obviating the evil have been attempted during the last few years with more or less of success, but one of the most persevering workers in this direction is Mr. James Newall, of Bury, Lancashire; this gentleman on March 21, 1862, took out a patent for lighting railway and other carriages with gas. In his specification the patentee states that his invention consists in the use of a vessel or cylinder, in which to compress gas by means of water, previous to its being conveyed to its destination for use. The apparatus of Mr. Newall, as at present employed on the Metropolitan and other railways, and for short journeys only, we shall now attempt to describe. The vessel or cylinder for containing the gas is an India-rubber bag, resembling a gigantic pair of accordian bellows, and it is placed in the brake-van of a railway train. The charging is accomplished by means of the pressure of a column of water of about 30 ft. in height, and which is ingeniously made to exert its weight upon the gas to be forced into the receiver by the aid of pipes and stop-cocks. Great care has to be exercised in charging the gas-holders, as the material is fragile, and over-pressure would inevitably rend them asunder.

Allowing that a train is to be lighted from this source, the service-pipes are run along the roof of each carriage, the one carriage being connected to the other by means of India-rubber tubing and union joints. By this arrangement the carriages may be readily united or disunited. Attached to the service are bracket burners let into the carriage roofs, and surrounded by glass, for the purpose of illuminating the interior. Such briefly is Mr. Newall's plan of lighting railway carriages, and the extension of it along a series of carriages only involves a repetition of the same plan. For this system of lighting carriages it will be obvious that considerable space is wanted; indeed, for every cubic foot of gas required to feed the burners, 1 cubic foot of room is needed at the outset for the accordion-like receiver. As the gas is gradually consumed, of course this latter collapses by force of its own weight. If it be supposed that a train of 20 carriages is going to run (say) a distance of 300 miles, it would require at least 60 lights in its various compartments, each light demanding about 3 feet of gas per hour. To supply this quantity without recharging the receiver during the journey (which would entail much delay, and is, therefore, impracticable), it would be necessary to give up the area of two and-a-half vans, measuring each 20 feet by 7 feet 6 inches, or a space equal to 2340 cubic feet, for the conveyance and storage of gas alone! It seems clear, then, that such a plan of portable gas lighting can answer satisfactorily for short distances only on railways.

Another drawback to the gas-bag mode of illumination is the liability of the India-rubber to injury, and consequent leakage, from abrasion at the corners. It is essential, too, that the gas be used immediately after it has been charged into the receiver, or the now well understood laws of effusion and of diffusion will take effect, and convert their contents into a highly explosive compound, such as atmospheric air and gas intermixed really becomes, and thus endanger the lives of those in proximity. Other disadvantages might be named, but they point in the same direction, and simply seem to negative Mr. Newall's plans, when the distance a train is to be conveyed is over a certain number of miles. Although this gentleman includes in his specification the right to use his invention afloat in steamboats, &c., it is difficult to imagine that gas can be either safely or economically used on the bag system for illuminating the cabins and saloons of passenger vessels, unless the voyages to be run are of the shortest kind.

It was our intention to have explained another mode of lighting railway carriages by gas, and which has been proposed by a gentleman who is at this moment engaged in conducting extensive experiments for the complete solution of the problem. As the subject is one of great interest, however, we the less regret the fact that want of space forbids our touching upon it at present, and compels us to promise a distinct paper on lighting railway carriages and ships' cabins with gas, however long the journey or the voyage to be undertaken by either. The inventor of the plan in question is Mr. W. Dalziel, of Deptford. JOSEPH NEWTON.

*Royal Mint, Tower-hill.*

### COAL STATISTICS VERSUS COAL STRIKES.

Sir,—Your Yorkshire Correspondent, in last weeks' Journal, states that "The recent notices in the press as to the result of strikes on the coal trade of the country have been the means of elucidating many important and even *startling* facts." We should think so; and, considering the *way* the facts have been "elucidated," perhaps the world will be a little more startled and astonished still. From the evidence before us, it may well be said that "nothing is so falacious as facts, except figures;" for we all know that by selecting, and *suppressing*, under changeable conditions, anything can be proved by both facts and figures. For instance, if any careful and respectable man give us the weight of corn and kine during the seven years of plenty in Egypt; and another, equally careful and respectable, gave us the statistics of weight and measure of the said corn and kine during the seven years famine; Pharoah himself might be puzzled to decide which was *untrue* as evidence of Egyptian production. But it is clear that neither would be true, as a whole. And thus we can understand and estimate how "startling facts" are "elucidated," when hireling writers for the press set themselves to select and to suppress *truths*, in favour of coal masters and against coal workers.

The general fact proved is that Strikes and Lock-outs diminish production,—a position no one in his senses will dispute. Yorkshire is made the fulcrum of this mighty lever of figures; or, rather, it is made the lever end of the sweigh-pole, which Unions and Strikes have driven to the bottom—Northumberland, Durham, and Derbyshire being elevated, and for which Strikes, Lock-outs, and the *Men's* Unions and *Leaders* are solely blamed as being in fault

There are two distinct subjects for consideration—the rate of the growth of mines, and the rate of production; and, secondly, the causes, primary and moral. Taking the first, to begin with, we see that the selection is made of increase of mines from 1853 to 1864; while production is selected from 1857 to 1864. Why? The writer must have had all the reports and statistics from 1853 to 1865 before him. I have only Prof. Hunt's reports of 1862, 1863, and 1865 before me, and the Inspectors of Mines' reports for 1864. As I am neither an agent for the men or a writer for the press, it could not be to my advantage to procure them; neither have I time or inclination, further than for *truth's sake*, to go into the subject at all. But feeling that interest, I borrowed those reports (all that the most respectable proprietors of a daily paper had at hand), and from them your readers will perceive the object of the selection.

The ratio of production is selected from 1857 to 1864; and we have then in Yorkshire, in 1853, the number of mines given at 276, and in 1865 at 422. We thus see the increase to be 146, or 125 per cent. advance in eleven years. The production is given at 8,875,440 tons in 1857, and only 8,809,000 tons in 1864. It would thus appear that the production had diminished 66,440 tons, whilst mines had increased 143 in the same period! Now, granting these figures to be correct, let us see whether another story cannot be told, by "selection." The number of mines given by Mr. Hunt is 276 in 1853, and 399 in 1856, an increase of 123 in only three years—nearly 90 per cent; while from 1856 to 1865 the increase is only 55, a little more than 10 per cent. in nine years! The production of the mines is not given in 1853. Why not? And why was the production selected of 1857 to compare with 1864? The explanation is very simple. The year 1857 was one of unexampled *over*-production, and which reducing the price of coal, as the masters said, necessitated a reduction of wages, and so brought on the first large Yorkshire Strike and Lock-out of our subject. On the other hand, 1864 is selected, a year of under-production, because the Barnlsey coalmasters locked out the whole of the miners, in order to reduce the wages, "causing a falling off of 592,900 tons as compared with the previous year, of the value of 190,000*l*." But let us take the production of 1864 at 8,809,000 tons from 419 mines (as Mr. Morton, the Inspector, gives them), compared with 1865, with the number of mines at 434, and the production 9,355,100 tons; we shall then have the mines increasing, according to Mr. Hunt, 15 and not 1 per cent., and the production 543,100 tons—over 6 per cent. increase in *only one* year. Mr. Morton reports, even in 1864, that in the fourteen years of his inspectorship the Yorkshire mines have increased in production from "6,750,000 tons to 9,250,000 tons, being an advance of 38 per cent.," Strikes notwithstanding.

We have thus a "selected" increase of mines over 11 years of from 276 to 422, or 125 per cent.; and a *decrease* of production from 1857 to 1864 of 66,440 tons, about 1¼ per cent., in seven years. And, on the contrary, we have from 1864 to 1865, only *one* year, not 1 per cent. increase of mines, against over 6 per cent. in production! And all may be true in detail. Of what use, then, are such statistics? And what shall we think of the men who make such misleading "startlers," only to make money for their own advantage? Is it not clear that the writer selected exceptional years of the increase of mines to compare with exceptional years of diminution of production, in order to throw the whole "startling" effect upon Strikes and Lock-outs, and in order to throw the fault upon the Men's Unions, and the blame upon their Leaders?

And this leads us to the second part of our subject. Granting that the whole of the results are as stated, legitimate and sequent, we now come to the "startling" question—Who caused the Strikes, and who effected the Lock-outs? The writer, who so unscrupulously and insidiously selects his figures to prove a foregone conclusion, is equally insidious and unscrupulous in both his foregone fault-finding and blame. He does not *say* directly that the men began the Strikes, and that the fault of the Lock-outs is due to the men's leaders, in the pursuit of their personal profit; but he always, and throughout, *assumes* it. It is the Unions he blames for driving the trade away to other districts and foreign countries, and the Leaders who make the contentions "profitable." Now, we have good reason to believe that the writer knew better than to assert openly what he covertly assumes. What, however, are the facts? There have been since 1844 only four *great* Yorkshire coal Strikes. The first was in the West Yorkshire district, in 1858-9. The second was in 1863-4. In the Barnsley district the first great one was, I believe, in 1859-60, and again in 1864. Now, in each one of these cases the disturbance was begun by the coalmasters' Unions giving notice of a reduction of wages, and in each case it ended by the employers being defeated. These general assertions I am prepared to prove, and also that the men of West Yorkshire had no Union *before* 1858, which ceased as soon as they had gained their object; renewed again in 1863, and is still continued. So at Barnsley the men had no continuous Union before 1858, while the coal masters have had Unions continuous for over 40 years. And these are samples of the lesser trade disturbances more or less prevailing over Yorkshire since then, with two exceptions. At Driglington the men resisted a reduction in 1862, and were beaten into a terrible reduction; while at Barnsley, this year, the men have, for the first time, obtained a general advance by union upon a normal pay price. But this was *after*, and because the coalmasters had advanced prices on account of demand. The men reasoned that demand for coals was also demand for labour, and that if coal was entitled to an advance on account of demand so was their labour. Very wrong of the men to think so, doubtless, only the fact is that it has been so drilled into the miners that price depends solely upon the relations of demand and supply, that they are beginning to apply the doctrine to practice. They have thus in Yorkshire a limited supply, and have actually obtained an advance of wages, they being told by the masters that the *over*-production of 1857 necessitated their reduction. (See speech of Mr. Briggs, coalmaster, at the Social Science meeting at Bradford, 1859.) And now what is the position of Yorkshire, where it is said the men have driven away the trade—their Unions being triumphant, and their Leaders dictators? Eight hours' work, good pay, 21 cwts. to the ton, men entertaining masters to good dinners, and masters inviting Leaders to their own houses, whom formerly they would not meet or speak to; and (shocking!), according, Sir, to your own reports—and the Journal should be an authority—Yorkshire was *never* so well employed, never so *productive*, and I may add never so *satisfactorily* working, since it was Yorkshire. Yorkshire will show a very different state of "output" for 1866, for, with trifling exceptions, there are no Strikes, and it is thought that their Unions will render Lock-outs impracticable.

But we have *Man* to consider, as well as Coal; and if the yield of Derbyshire be greater at 28 cwts. to the ton, than that of Yorkshire at 20 to 21 cwts., what of the men? What do the men themselves say? Witness the increase in the number of members of their Union, from 300 to 7000, in three months. A Looker-On.

### LUTEOLINE.

Sir,—It is a singular and remarkable fact in this eminently progressive age, amid the various improvements and changes in the present era of scientific wonders, that gunpowder still holds its foremost place, in spite of several efforts to displace it. This is a very striking circumstance, inasmuch as black gunpowder is not without serious drawbacks to its use, amongst which we may enumerate its tedious process of manufacture, its liability to damp when made, the dense smoke produced when exploded, caused by the presence of charcoal; loss of power when ignited through the presence of fixed saline matter (salts of potassium), &c. We repeat, it is a matter of astonishment that no partial substitute has ever been adopted. It is true that Gun-Cotton, Pyronome, Glonome, and some other nameless compounds, have of late years been proposed, but their use has as yet been exceedingly limited. The recent serious and alarming accidents with Glonome, in Australia and at Aspinwall, have sufficiently demonstrated the extremely uncertain nature of that powerful agent, and has, consequently, made people shy and careful in its use. Gun-cotton, again, though it underwent a careful series of trials at the hands of the Austrian Government, has not been favourably reported on, neither did we hear of its use during the late war. Lenk and others have greatly improved it, but it still labours under a serious disadvantage—its fouling firearms. A fatal defect, if intended to supersede gunpowder, which, though far from perfect in that respect, will still bear a favourable comparison.

But though gunpowder is not yet superseded in its use for firearms, still the question arises—Why should it yet be used as an explosive material for shells, petards, &c., which should manifestly be charged with as combustible an agent as it is prudent to use? Now that shells as well as shot can be made hard enough to pierce the sides of iron-clads, it is evidently our object to make the blow as destructive as possible, by shattering both the plate and its backing. This is but imperfectly attained by the use of ordinary powder, and we are,

therefore, naturally led to seek another material, which will better serve the purpose required.

With this view the new agent, Luteoline, is brought forward as a bursting medium. It presents the appearance of a fine powder, and makes but little smoke in exploding; its specific gravity is rather greater than gunpowder, but its strength is more than double. It is not liable to damp, having been kept, without any precaution, in a box for two years, and was found on examination to be unimpaired in its qualities. It might be also useful in mines, as the gases generated are neither dense nor sulphurous. Its price at present is about the same as the best sporting powder, but a demand would, of course, cheapen it, and its far greater strength renders it more economical now.

Thus far we have alluded to this novel agent as a bursting medium where great rending power is needed; but some experiments are at present being conducted with a view to test its adaptation as a cartridge powder. Before long we hope to be enabled to form a definite opinion on the results, which will be duly reported. The chief point to be settled, as may be guessed, is the fouling of the gun, and till this question is satisfactorily answered, it would be idle to speculate on the extent of its future use. E. A. DE LANCEY.

## SODIUM AMALGAMATION.

SIR,—I have read with much interest the correspondence in last week's Journal on "The Utilisation of Sodium in Gold and Silver Amalgamation." If my name had not been mentioned in the correspondence I would not have troubled you at present with any remarks upon a subject which is, undoubtedly, of vast importance, although, probably, of more importance elsewhere than in this country. Practically I know nothing of the amalgamation of silver ores; but it is known that I have dabbled a good deal in the amalgamation of the gold ores of Merionethshire, where, often, the metallic sulphides, and other hindrances to perfect amalgamation, baffle all endeavours to extract the precious metal therefrom by the usual modes of trituration in quicksilver. The introduction of sodium, however, I believe will, at no very distant day, effect a great change in the gloomy aspect of Welsh gold mining. The use of sodium in other countries has been beneficial. Why not in Wales?

With respect to the conflicting claim of Professor Wurtz and Mr. Crookes to the priority of discovery, I think I ought to say a word or two. Early in 1865 Mr. Crookes, then a stranger, called on me at Stretford, and told me that he could solve the Welsh gold-amalgamation problem. Such a proposition was by no means a novelty, but I listened attentively, and, I must also say, with a great deal of pleasure to the observations of this eminent chemist. At this interview Mr. Crookes did not give me, neither did I ask him for, the slightest clue to his specific. I submitted to his inspection from my cabinet specimens of the evil spirits that had so long tormented me, in the shape of pyrites, blende, galena, bismuthine, &c., and told him that, as far as I knew, I had tried all the plans of amalgamation, and that I was at last almost inclined to believe that it was impossible to extract gold profitably from such ores by any mode of triturating them with quicksilver, for there were so many accidental deviltries attending the operation on a large scale, and that what I could do easily enough in the laboratory could not be done at all at the mines. Mr. Crookes was evidently much surprised at the extraordinary richness of some of the gold specimens, and, naturally enough, believed in his ability to effect a great reformation of the amalgamation question. He invited me to witness two barrel experiments on some Californian gold quartz at Mr. Spence's works, at Newton Heath—one with quicksilver in its ordinary state, and one with quicksilver containing what he at the time, I think, called a reviver. In the contest the reviver-barrel came off the victor as to the produce of gold. I did not look upon this as any proof whatever in favour of his plan; for as I did not believe in the possibility of fairly sampling gold quartz the result might be accidental. But I had taken in my pocket a piece of Castell Carn Dochan iron pyrites, containing rich visible gold, so much tarnished with sulphur that quicksilver in its ordinary state would not touch it. To this Mr. Crookes applied some of his prepared quicksilver, and amalgamation instantly took place. This fact surprised me very much, and I made an appointment to meet Mr. Crookes in Wales, at the Castell Carn Dochan Mine, and challenged him to an amalgamation trial of the old plan against the new. In the meantime, my assistant, Mr. E. Williamson, and I set to work to find out Mr. Crookes' secret reviver. We soon hunted it down to potassium or sodium; and having some sodium at hand, we discovered that we too could make quicksilver readily attack the gold in a piece of iron pyrites corresponding exactly with that before treated by Mr. Crookes.

I met Mr. Crookes at the mine, and he first told me then that he used sodium. We experimented, as far as possible, under similar circumstances, only that Mr. Crookes used sodium-amalgam and I none. His gold produce was better than mine; but as the quartz, &c., at Castell Carn Dochan had never yet "sickened" quicksilver, and as we practically extracted all the gold without sodium, I did not attach much importance to the experiments. These results might, also, be accidental. Just then I had some amalgamation going on at the Gwynfynydd Mine, where arsenides, &c., preponderated, and altogether prevented gold amalgamation, although the mineral was very rich. This was a grand opportunity for Mr. Crookes and his sodium process. We went to the works, and found the quicksilver more completely "sickened" than I had ever before seen it. Mr. Crookes put in some sodium-amalgam, and in a short time the quicksilver recovered its fluidity and brightness, and we got a most satisfactory quantity of gold. There could be no mistake about this new fact. I followed up the subject very closely, and made a series of experiments independently of Mr. Crookes and the sodium-amalgam prepared by him. I put all the mineral substances most antagonistic to amalgamation to the test with sodium in various quantities, and for different periods of time. I did not in all cases obtain gold; but in no case did the quicksilver "sicken," and in all cases it was perfectly bright, and the particles easily aggregated.

From these trials I elicited that a very minute portion of sodium would produce the desired effect, that an excess of sodium would be prejudicial, and that I could extract gold by the use of sodium from ores that yielded none by amalgamation without sodium. I made this known through the *Mining Journal*, and I think it was the first public allusion to the subject in England. I afterwards wrote to Mr. Moshemier, in California, informing him of Mr. Crookes's discovery, and he, in reply, gave me to understand that my letter in the Journal was the first intimation of it in California. Whether this was so or not, I have no means of knowing; but it appears to me singular that so important an application of sodium should not have found its way from the laboratory into the public journals, had it been known on the other side of the Atlantic. It is said that the application might have been inferred from Gmelin's "Hand-book of Chemistry;" but, as far as the public know, nobody had inferred it. It is quite possible that Dr. Wurtz and Mr. Crookes are both discoverers, only that Mr. Crookes first thought of applying the discovery. The subject in this country, though important, at the present time is not likely to receive the attention it deserves; for, independent of other causes, mining generally seems to have collapsed, and gold mining more especially—tin, copper, &c., from the low price of metals, gold from a varity of causes; not, however, from the low value of gold, or its non-existence in Wales, but more chiefly from the fact of operations having been attempted where many of the conditions essential to success are wanting; the chief of which are an insufficient quantity of the auriferous mineral, and the want of efficient and continuous water-power.

The rich Clogau Mine fails less from the small quantity of gold now found in the lodes than from the impossibility of operating on thousands of tons per month by water-power instead of a few tons.

The results at Castell Carn Dochan show that on only 200 tons a month even ¼ oz. of gold to the ton will pay all expenses, which is the most important fact that has been elicited from actual gold extraction in Wales, for it is certain that if this 200 could be multiplied by 10 or more, a satisfactory profit would necessarily accrue. But, unfortunately, there are only two or three places in the Dolgelly district that can produce cheaply and quickly large quantities of auriferous minerals, and efficient and constant water-power to work them, and they are the mines near the Mawddach waterfalls. And, notwithstanding all the past misapplication of talent, money, and apparatus, I dare venture to predict a future of great success for this locality, if only these waterfalls are made to reduce 50 or 100 tons of quartz a day, by the appliances now known, and the use of sodium-amalgam.—*Chester, Nov.* 28. T. A. READWIN.

## TO THE PRINCIPALS OF BUILDING AND HYDRAULIC CEMENT MANUFACTURING FIRMS.

GENTLEMEN,—The recent fire in Quebec has occasioned a great demand there for the reconstruction of houses, which will doubtless be of stone, and not of wood, as they were before; consequently, in the course of next summer, there must be in that city a proportionably great demand for building stone. Now, although the "black rock," on which is situated this city and fortress, may be used, and is so, *for backing in*, it is entirely unfit for outside work, in consequence of its shaley character, so that stone for frontage or facing *in situ* must be sought for, either in the limestone quarries of Beauport and Montmorenci, or the grauwacke ones of Cap Rouge, situated from three to seven miles from Quebec.

In the year 1834, having previously ascertained the fact that a large portion of this black rock was convertible into a water-setting lime by the usual process, I took out a patent in Quebec to secure to myself the credit of the discovery, which expired in 1848, and has not been renewed. In the year 1854, twenty years after the date of my patent, one Gauvreau, who I have reason to believe assisted me as a labourer in making my experiments to establish the discovery, took out a patent for the same, and although he does not dispute my right to be considered the original patentee, he has parted with the usurped rights conferred by his patent to another, who has been working them ever since as a monopoly, to which he obviously has no sound legal right, for from the moment I neglected to renew my patent the discovery became public property, and the field open to anyone to embark in the manufacture of this cement; and, indeed, from the first, even by myself, I doubt that such a monopoly, commercially considered, could have been legally maintained, and I never sought to maintain it.

Besides the fitness of this cement for hydraulic purposes, it forms, when set and thoroughly dry, an excellent stone or brick, which in the open air attains gradually an unusual degree of hardness and insolubility; it is, therefore, not only suitable as a mortar to unite stones together (and its adhesiveness is remarkable), but also to be used for the facing stone itself, and that, of course, without any dressing, while the black rock it is derived from is inexhaustible, and in the removal of which for building purposes space is obtained for building: no small consideration in a city like Quebec, where the black rock crowds upon the wharfage ground. I am satisfied, under good management, that the quarrying, burning, and grinding on the spot of this black rock on a large scale would not equal in expense that of the quarrying and transport of an equivalent quantity of limestone and grauwacke from the quarries I have alluded to, particularly when I consider further the absence of the dressing, and the presence of the bitumen and carbon in the black rock, which renders the consumption of fuel less in burning it than it would otherwise be. So much, indeed, is the presence of these minerals characteristic of this rock, that I have sometimes thought portions of it might be made to supply gasworks. However, these considerations are independent of its exclusive use, as a local deposit, for the supply of hydraulic lime in the construction of piers and other works of a similar nature, so much desired in Quebec.

In affording this information I look for no recompense, unless, indeed, it be acted upon successfully, and even then, of course, the granting it entirely depends upon the actors. Hitherto the discovery has been a pecuniary loss to me, for those who should have made it otherwise have failed to do so, and my position, as an officer of the army and anti-capitalist, interferes with my becoming a manufacturer.

I remain, your obedient servant,
THE ORIGINAL PATENTEE OF HYDRAULIC CEMENT FROM THE BLACK ROCK OF QUEBEC.
1, *St. James-place, St. James-street, Brighton, Nov.* 26.

## ALGERIA.—No. III.

SIR,—We traversed and examined fully 50 miles along the northern frontage of the Atlas Mountains, beginning eastward at Ain Baida, and travelling westward towards Batna. The site of Ain Baida, an Arabic word, which means the White Spring (great importance being attached to springs of water in that country), is beautifully situate, overlooking a large salt lake. The town is exceedingly well watered, irrigating streams being conducted to the houses and gardens in every direction. This position is not far from the confines of Tunis, and the Arab population have not long entirely submitted to French rule, but we saw nothing but subordination and order, and the military element existed in such proportion as to render any attempt at riot difficult, if not impossible. We found in the rock surrounding and throughout the district the fossilised *Pecten*, as beautifully preserved as if it had only that moment been taken out of the sea; and, in addition, to the fossil, we sometimes observed parts of the real shell attached to the impressions in the stone. Knowing that we were in the cretaceous formation, we thought it useless to explore the country for metal, and we started westward for Ain Cranchla, through a land so destitute of the media of civilization that we could scarcely find a tract to direct our way; notwithstanding this, the ground was so level and favourable, that our carriage, drawn by three horses abreast, traversed these grassy plains at the rate of fully 5 miles per hour, and in about three hours we arrived over a series of gentle valleys and rising ground (in wet weather inundated, and impracticable for travelling) at the residence of a Caid. His house was situate by the side of a brook; he, with great consideration and politeness, sent us a beautiful carpet, milk, eggs, cocussu, and other good things. We spread our carpet under some trees by the stream; the Caid joined us at coffee, and we enjoyed an excellent *dejeuner*.

It is ungrateful to pass through a country and receive the hospitality of the inhabitants without acknowledging it, and I must, by-and-bye, devote some lines to this subject; important to us, as it may be to some future traveller, and honourable alike to the Arab and French elements of society in Algeria. In the evening, passing westward over an undulating country, we arrived at the military station of Ain Cranchla, which I have mentioned before, and which I consider to be the eastern extremity of a considerable metalliferous province. In the sandstone beds, between the limestone layers, we found several sorts of fossils; amongst others, the Cardita. These were a little below an immense outcrop of iron, towering up in the rude outline of an old castle, from the great copper lode about 300 yards to the west of Ain Cranchla, and between that station and the hotsprings some Roman mining work had been done, and no doubt that people turned the produce of iron to account for their own purposes, although I believe the iron will change into an extensive deposit of copper in depth. We followed the range of this great copper lode from Ain Cranchla westward for 20 miles, to a place called Chabot-Egros, where the outcrop of it was a great deal mixed with mercury, some specimens of which I brought with me to England. We, however, fixed our tent at a mining trial called Rhyloumdjin, "the Brook of the Mother of the Genie;" this place is about 6000 ft. above the level of the sea. The top of the mountain was capped for some hundreds of yards in extent with a convex bed of carbonate of barytes, from 8 to 10 ft. in thickness, deeply stained with the chromates of copper. The rock of the country was limestone, much charged with fossils, amongst which we found a curious kind of oyster, almost like a Nautilus, as well as the Spondulus, the Venus Cardita, and other shells. Under the cap of barytes an adit had been driven and a copper lode discovered, yielding 5 or 6 cwts. per fathom of rich grey ore, holding about 20 ozs. of silver to the ton.

From this point there was not more than 12 miles to the great Sahara Desert; mountain rose over mountain in this direction—that is, to the south—and we had to explore them in order to complete the transverse section which we had now passed over from the sea southward for some 130 miles from these, and to a height of some 6000 feet. I should think we asceended in four miles between 2000 and 3000 feet. Near the crest of an immense mountain I left my friends, and went behind the summit to the south, but the whole scene was wild and desolate to an extent almost impossible to imagine; a pair of eagles were wheeling in circles overhead, evidently watching my movements, and, I thought, thinking to themselves, "If he makes a false step he is ours." The cliffs of rock were highly precipitous, and large detached masses of it lay about at intervals, while long, rushy grass rose in patches above my head. I said to myself, "This is the veritable home of the lion and panther." I really expected every moment to come upon the lair of some beast of prey, and as I had no gun with me, and had dined the night previously to the accompaniment of the roar of the king of the forest, and evident, too, of this miserable region, after casting a furtive glance at the hills and valleys to the south, leading to the great Desert, I can assure my gentle friends that I lost no time in retracing my steps to our temporary home amongst the oak forest of Rhyloumdjin. I noticed near the very summit of the mountain a series of lodes and cross-courses that would in Cornwall have delighted the eyes of the natives; but their time will not come for many a long year, seeing that the railway will not be finished for the first 60 miles to Constantine in less than two years, and from there over the plains to this district such a work has, I suppose, not been even yet contemplated. Our only inhabitants at Rhyloumdjin were an Arab, called Kalafat, with his wife and children. They supplied us with milk, mutton, partridges, pigeons, &c., and told us a curious story as to the character of the lion. They said a lion had come there one day, and only finding Mrs. Kalafat at home, had mode so free with the sheep as to seize upon one of the lambs; but Mrs. Kalafat not liking this proceeding attacked him with a stick, intimating that he was Christain, a gipsey, and a Jew, at the same time snatching the lamb out of his mouth, and, after growling a little, he went off seemingly thoroughly ashamed of himself; if so, truth is stranger than fiction.
*Nov.* 28. COPPER MINER.

## MINING IN IRELAND—No. III.

SIR,—Owing to circumstances painfully apparent in the columns of the *Mining Journal*, I have been unable until now to resume this subject. I do so by stating that it has appeared by numerous letters addressed to me in my private capacity, as well as by observations from correspondents in the Journal, that the subject of my papers is at length beginning to attract more attention than has heretofore been vouchsafed to it. It may be necessary on my part to reply to one communication by saying that when I referred to the quality of Irish mineral produce I meant the ores of the island taken collectively; in doing so, however, I do not see that I could have mislead, or could have been supposed to have intended or desired to mislead, anyone. The low-priced ores of the Wicklow Mines are so abundant as to fully compensate for their lack of copper percentage; they are, properly speaking, sulphur ores, and as such should be valued, as they suffice to yield splendid dividends, which after all are the results mainly desired by mine adventurers, who little heed the cognomen under which the produce is rated.

"A Tipperary Miner" will, I presume, surely not claim any special value over other localities for the generality of Irish silver-lead ores; if he does, I think he errs. The silver-lead ores of the North of Ireland are not rich in the precious metal, seldom yielding as much as 8 ozs. per ton of lead—there are, of course, exceptions, but comparative poverty is the rule. These ores have, however, the advantage of being admirably adapted for pottery purposes, and come under the category of potters' lead; they are, accordingly, held in high estimation. If carefully selected and properly dressed they find a ready market on the spot; large quantities are consumed by the local potters at Coal Island, county Tigrone, and various other places.

These are solid and permanent advantages, and are of mutual benefit; the potters are spared the trouble of importing their lead, and thus are able to give the miner an enhanced value; the miner is saved the trouble and cost of carriage, sampling, delay in time and payment attendant on the routine of ore sales (no trifling items). The potters pay cash on delivery; the prices range about 15*l.* per ton for first quality potters' lead; to which, also, should be added the costs which would have to be incurred were the ore to be sent for smelting purposes, say, 2*l.* 10s. per ton—equal to 17*l.* 10s. per ton, a fair price for average British silver-lead ores. Parcels of the same lots have been sent for sale to the Dee, &c., by way of proof, and the ticketing seldom ranged above 14*l.* per ton. If properly dressed, the quality of the Irish potters' lead is very superior, and would ensure a demand for all that could be raised at extreme rates.

The greatest drawback to the permanent prosperity of Irish lead mining is the exorbitant rates, or total refusal of the landed proprietors to allow their lands to be wrought. Some object from fear of their game being poached; others because a few trout may be imperilled; others, because they want all the profit, and shrewdly remark, if you did not think a vast store of riches lay beneath the soil you would not come there and lay out so much money; others, again, will not grant because they won't. The remains of ancient works, as well as the names of the places, evidence the existence at some remote period of prodigious mining explorations. Shafts, open cuttings, and dressing-floors of the most primitive description are to be traced for miles on the backs of what appear to be true north and south lodes. From their extent, there can be no doubt of their former richness: names such as Silver Hill, Silver Mines, &c., have their significance.

In contradistinction, however, to such "dog in the manger" conduct I have alluded to, I have the gratification to be enabled to announce, through so important a channel as the *Mining Journal*, that the proprietor of one of the principal of these favoured neighbourhoods has been so impressed with the truth of the remarks made in some of my previous communications, that he is disposed to grant leases of his properties on most liberal terms, requiring no guarantee but that the mines shall be fairly wrought, and that the leases shall not be obtained by speculative parties for the purposes of re-sale and market rigging. This is but fair, and is a step in the right direction. Some of the specimens I have seen are incredibly rich for silver, being, in fact, silver and not veritable lead ore. This valuable ore let it be understood, is not from the North of Ireland, but is from the county Galway. The district is remote, and, perhaps, for that reason neglected in modern times; not so in former days. The strata are clay-slates and limestone in close proximity; in fact, very much resemble the formation of certain mines in Cornwall and Devon, such as the Tamar Mines, and the rich ore is associated with blende and carbonate of lime, barytes, &c.

Should any parties be desirous of further information respecting these veins, and as practical utility is the aim of my endeavours, I am ready and authorised to give them, if prepared to carry out the conditions above named, an introduction, and afford every facility. It will be, indeed, well for Ireland if Irish capitalists can be made aware of Ireland's mining riches. They would afford ample employment for all the population, and would tend more to defeat the ends of the insane Fenian conspiracy than a host of armed police or ever so well drilled soldiers. Prejudice argues, and argues falsely, that the lodes of Ireland do not hold down rich. Evidence, where evidence has been tested, proves directly the reverse. They not only hold down, but improve in depth, where the strata are congenial, and such as a practical miner would recognise as being calculated to contain deep-holding lodes. The foolish idea that flat lodes are not productive having some advocates has also militated against the discoveries made near the surface in Ireland, whereas it is a well-recognised fact that flat lodes have generally been the most profitable, and frequently lead to junctions with vertical veins, and at these points yield "houses of ore." But were I to recount all the objections raised by interested and prejudiced parties I might fill a page of your valuable Journal. For the present, what I have said must suffice.—*Dublin, Nov.* 27. GEORGE HENWOOD.

## CALDBECK FELLS MINES.

SIR,—The present unfortunate state which appertains to this company from the alleged misconduct of its late London official mus be my sufficient excuse for thus addressing you. I must, however, premise by informing you that I am not a shareholder, nor am I interested in any way directly or indirectly, but as I know the mines and the district, beg to venture a few remarks thereon—not, however, to discourage the shareholders, as I conceive that they possess a most excellent property, which, with careful and prudent management, will by-and-bye realise to them large profits. I opine that there must be a moderate immediate call, as the present funds have vanished. * * * But, be the office in Wigton or London, I would advise "the powers that be" to work the mine in good earnest, by extending the 90 fm. level into Silvergill, as also into the western ground, as well as eastward to Mexico. Within this range there is good paying ground for many a year to come, without the expense of a steam-engine or sinking another fathom deeper, as the sinking can be done when required, and when funds are in hand to do so. The ores are made up of what is called (locally) yellow and blue lead,

with a little copper in depth; these are found to merge into galena (blue lead), holding about 14 ozs. of silver to the ton. The yellow lead ore is composed of selemnite, phosphate, arsenite, and some carbonate of lead, holding but little silver. With prudent management the mine is capable of giving 100 tons of ore per month from above the 90 when properly laid open. Drygill, which is eastward, gives fair promise for lead if the level from the Beck going westward were extended, and at Carrock end there is a good copper vein, which a portable engine would enable to be proved. On the whole, Sir, there is much to encourage shareholders in this mine, but they must manage it efficiently and prudently.

*London, Nov. 26.* C. E.

## ON SLATE, AND SLATE QUARRIES.

SIR,—Absence from town has prevented my answering the remarks of a "Man of Experience," which appeared in the Journal of Nov. 10, until now. I admit I committed myself, but not intentionally, when I touched the Festiniog man on his sore point. Had he been wise and forgiving he might have looked over my incautious words; as it is, I am bound to tell him that it is not unlikely I surveyed professionally Festiniog quarries before he was born, and have continued to do so occasionally ever since. The last time I was there was to survey and report on Messrs. Percival's quarry. Then, who is this "Man of Experience?" I recollect strolling into a quarry when there, and a man of consequence came forth, who evidently wished to expound his knowledge on slates and slate quarries, and he gave me such a lecture on quarry working as I had never before heard. Seeing he was a novice, I just made a few sharp remarks to him. I took up one of his slates, and asked him to tell me the way that slate grew in his quarry. This finished him, and he appeared confounded. On making enquiry I found this man was a Cockney, only ten days out of London. About three weeks since I was called in at a meeting on a Welsh slate quarry, when one of the party took up two of their slates and pronounced them worthless, as he said they were coarse and rough in the grain, and were not saleable. The slates were handed to me. I tested them by striking them on a point, and they stood the test well; and I told him I thought him no judge of slate, when he at once insisted on his being an experienced judge of slate. I then asked him to point out to me the grain way of the stone, a most material point to know in Welsh slate, and particularly so in Festiniog; and he gave me the grain way *vice versa*. I have now reason to think the "Man of Experience" must be one of those men. As to the colours, all must be aware that the number is very limited. Will he tell me the prevailing colours to form blue? Were he to look round on the houses in England covered with Festiniog slate, of from three to five years, he would discover they were not blue, but smoots, the worst of all colours. Then he goes on to tell what constitutes a good slate. He says lime does not give lamination or cleavage, but alumina and silica do. I venture to tell him that silica and alumina combined have little or no cleavage unless magnesia or potash, or both, are present to some extent. Magnesia causes slates to be elastic, and gives cleavage. He may also tell me what rock does not contain iron. Iron will not injure slates nor make them rust if sulphur is not present; when the two combine, the sulphur decomposes first, and throws out a red iron rust, if he likes to give it that name; but slates that contain lime oxidise, and they become smoots, and not covered with red rust. There are slate quarries in Devon in veins 10 ft. thick, in masses of lime formation. They are the colour of the Festiniog slate, and have a fair cleavage; but they, like the Festiniog, all become smoots in three or four years. As to prizes being awarded to them, it is all very good. These slates split thin, are smooth, and look well to the eye; it is for this they have two prizes, and not for durability. But who awarded these prizes? Is there one in a hundred who is a judge, and knows the cleavage way, or their strength and durability? I say that there is not a practical man in the lot, or one that is a judge of slate. I still contend that a rough-grained slate is the most durable, if free from sulphur and lime. I say Bangor, Llanberis, Westmoreland, and Cornish slates are 30 per cent. more durable than what I call black Welsh. The latter will not now sell in Scotland. The Scotch are wide awake, and, like myself, have learned that rough slates of fair thickness are the most durable. A word more on thin slates. Who uses them? Why, the builders, who cover by the square. They get two to one in freight. They cover the house; it looks very well to the inexperienced owner; they get their money and clear out.

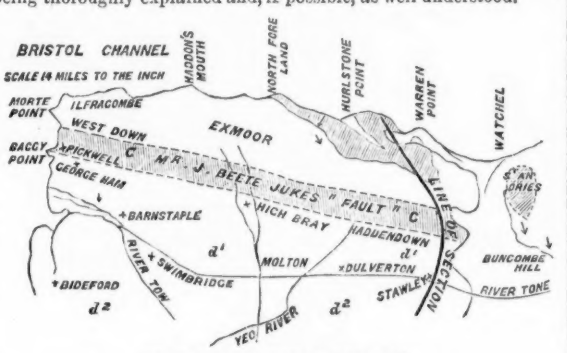
I next come to the "Man of Experience" telling me how to put slates on a house. May I venture to tell him that I have had 50 years' experience in different counties and different kingdoms in selling slates and putting them on by the square, and have many times, when employing an inexperienced man, like himself, gone and taken them off and replaced them myself? Next comes his advice to read a book on slate; to this I demur, until he convinces me that the author is not a theoretical man, who writes for theoretical men like himself to read. I never read these works, particularly on subjects I write upon from my own practical knowledge. In conclusion, I may remark that Festiniog slates are a fair average slate to use, if made thicker. N. ENNOR.

P.S.—It is worth remarking that a commission sat seven years selecting stone of which to build the Houses of Parliament. I need not say the whole mass is crumbling to pieces. Let every passer-by look at it, and judge for himself. Could these be men of practical experience as to good stone? Thus, some would-be great man connected with its building must have something new to cover it with, and he selected green slates. These are composed of silica and alumina, but over-charged with silica, and are generally a rough slate, with bad cleavage. Still they are a durable stone. Then the rage set in for green slates, and anything of a yellowish or greenish shade were bought up at fabulous prices. I some time since was offered a lot of top unsaleable slates, 60 per cent. under the bottom slate price, because they had turned of a greenish yellow. I called to see what they were, and was told a London builder had purchased the lot at the full price, to be sent to London as best green slates. Let any man call at Somerset House, and he will see at the south-east corner of the main square a great many loads to be used on that building, that contain 75 per cent. of silica, but little alumina. They will not cleave so well as the old gun-flint, but they are very durable when put on. But, bear in mind, these are not like black Welsh, over-charged with alumina; they are over-charged with silica, and very durable. The "Man of Experience" may not be aware that 75 per cent. of all the earth is silica. Then, what is silica? It is not yet proved to be a metal. Alumina is proved to be a metal. Will he give us a hint as to their substances, and when they joined heart and hand to form slate? N. E.

EXTENSIVE IRONWORKS IN AUSTRIA.—The very extensive works of Baron Rothschild at Wittkowitz are situated in the coal district of Moravia, in the vicinity of the small town of Ostrau. They are upon an extensive mining property, producing coal and iron ores of different qualities. The coal mines of Ostrau are of great celebrity and importance, not only in Austria, but throughout the south-east of Germany, as they are the only mines within that portion of Europe which produce coking coal of high quality. Baron Rothschild is the proprietor of some coal pits near Ostrau, the produce of which is partly sold as household and steam coal, and partly coked in ovens for the use of the iron-works at Wittkowitz. The Ostrau coal is said to yield on an average about 60 per cent. of very good hard coke, tolerably free from sulphur and other vicious impurities. The ironstones worked in the neighbourhood are mostly argillaceous ores of an inferior quality, and of a comparatively low percentage of iron. The purer classes of ore are found in small quantities, and their yield is not very great. The position of Wittkowitz is, therefore, more suitable to the working of Hungarian charcoal pig-iron made in the Carpathian districts from excellent spathic ore, and the two small coke blast-furnaces at these works have been erected mainly for utilising puddling-furnace cinders, which produce foundry iron of tolerable quality when mixed with the ores from the neighbouring mines. The whole works were originally laid out for puddling and rolling, with a capability of production amounting to 300 tons of finished iron of all kinds per week. The staple article at Wittkowitz is rails, the chief consumer being the Northern Railway of Austria, which passes the works. At a comparatively early period these works began to produce puddled steel with very good practical success, but with small commercial advantage. The process of making hollow wrought-iron axles, as practised at Wednesbury, has also been introduced by the patentees, but has proved unsuccessful. In 1865 Baron Rothschild sent his manager and two engineers to Sheffield to study the Bessemer process at Messrs. Bessemer and Co.'s works, and after having carefully collected all the necessary information, and successfully converted some Hungarian pig-iron in Sheffield, a Bessemer apparatus was erected. This consists of a pair of 3-ton convertors, copied from English originals, with some slight improvements in several details, and a small vessel of 1 ton for experiments and trials. The blowing-engines are horizontal direct-acting, and some of the boilers are worked by the waste heat from the melting furnaces. The ganister for lining the vessels is replaced by a compound of ground quartz from the neighbourhood of Olmütz, and of fire-clay from Blanske, near Brünn. This material stands perfectly well, the vessel working 60 to 80 charges before requiring relining. The quartz is treated precisely in the same manner as the road ganister in Sheffield. The tuyeres are also manufactured at Wittkowitz from Blansko fire-clay. It has been found useful to grind the burnt tuyeres and fire bricks, and mix the dust with the fresh fire-clay for making new tuyeres. Mr. Elberzhagen, the manager of the Wittkowitz works, has invented a very handy moulding-machine for making the tuyeres for the converting vessels. It is constructed upon a similar principle to that of the well-known moulding-machines for foundries. The grey iron for the Bessemer process, and also the spiegeleisen, is brought to Wittkowitz from Hungary at a price which is somewhat enhanced by the freight, the pig-iron being conveyed on carts, in the absence of railway communication. A railway from Oderberg to Kaschan has, however, been conceded and guaranteed by the Government, and it is expected to be commenced shortly. The opening of this line will place Wittkowitz in a more favourable position as regards the prime cost of pig-iron and Bessemer steel. The forge at Wittkowitz comprises four steam-hammers, from 1 to 5 tons weight, and a series of other accessories, such as squeezers' bellows, but it requires further additions for satisfying the demands of the new steel manufacture. It is proposed at present to erect a large steam-hammer and several other modern forge implements to complete and extend the Bessemer steel plant. The rolling mills are of ample strength for rolling steel. They consist of a mill for rails, driven by a vertical engine of 100-horse power, with a very large fly-wheel, a second similar mill for angle iron and other sections, a mill for boiler plates, with rollers 5 ft. 6 in. wide, and a mill for bar iron, to which is added a so-called universal mill, having two horizontal and two vertical rolls, adjustible in distance, so as to produce flat iron of any width with the same set of rolls. The production of iron tyres and wagon wheels was carried on successfully for many years, until the introduction of weldless tyres began to supersede that manufacture. The machinery for finishing tyres is very complete and effective, and is intended to be applied to the manufacture of weldless Bessemer steel tyres, which is about to be commenced. Messrs. Deakin and Johnson's process for punching steel axles and hollow shafts is also under consideration for eventual introduction. When in full operation the works at Wittkowitz employ 4000 workmen; they are considered the largest ironworks in Austria, and are at this moment the finest and best-arranged steel works in that country.—*Engineering.*

## THE OLD RED SANDSTONE THEORY, AND THE GEOLOGICAL SOCIETY OF LONDON.

The County Cork "Old Red Sandstone Theory" of our otherwise deservedly much-respected leading geologists and compilers of the Geological Ordnance Map of Ireland has, we are pleased to learn, suffered a signal defeat at a recent meeting of the Royal Geological Society of London. It appears that our esteemed townsman, Prof. J. Beete Jukes, M.A., F.R.S., director of the Geological Survey of Ireland, had submitted to the council of that society a lengthy paper on the geological structure of part of North Devon, with a view to having it read at the first meeting of the season. As Mr. Jukes attended avowedly for the special purpose of personally supporting his views, and illustrated them by plans and sections, his new theory for the well-beaten track of North Devon had every possible chance of being thoroughly explained and, if possible, as well understood.




REFERENCE TO PLAN OF "FAULT."

*a*,—New Red Sandstone, lias, &c. | *d*¹,—Carboniferous slate.
*d*²,—Coal measure. | *c*,—Old Red Sandstone.

SECTION FROM STRAWLEY TO MINEHEAD, A LITTLE WEST OF WIVELISCOMBE, SOMERSET.

Mr. Jukes's paper was, however, most severely handled by Sir R. I. Murchison, K.C.B., F.R.S., &c., Director-General, and Mr. Etheridge, F.R.S.E., Paleontologist to the Geological Survey of the United Kingdom. Sir Roderick emphatically declared Mr. Jukes's theory as "diametrically opposed" to the convictions at which he and every other English geologist of note had arrived, including Sir Henry De la Beche, late director of the Ordnance Geological Survey, whose elaborate report on the Geology of Cornwall, Devon, and West Somerset, published by order of the Lords Commissioners of the Treasury, will undoubtedly remain a standard book of reference on its subject. Mr. Etheridge followed Sir Roderick with paleontological evidences of Mr. Jukes's errors, but the latter retired, with the observation that he had no doubt that the grouping and the age of rocks would ere long be determined without the aid of paleontology. Mr. Jukes may be correct in this expectation; but, if so, we are sure that lithologists will be the most difficult to be persuaded that there is a single cubic foot of Old Red Sandstone in the south-west of Ireland, which, according to their scientific and decidedly more practical judgment, is of the Silurian or old grauwacke series. We have been fortunate enough to secure a reduced copy of Mr. Jukes's section and plan, referred to above, which we have inserted. No doubt the London Royal Geological Society will publish Mr. Jukes's paper in their next Quarterly Journal. If so, it is to be hoped that the objections made to it by Sir Roderick Murchison, Prof. A. C. Ramsay, LL.D., F.R.S. (Vice-president), Mr. Etheridge, and others, will also appear, otherwise it will give the impression that the paper had been received with concurrence. It is, we are convinced, a great loss to the chief aim and object of the society—the diffusion of knowledge—that the council do not invite or permit shorthand writers to attend their meetings, although it would be prudent to pledge them to submit their notes to the revision of the curator, in order to guard against errors in pure technicalities.

DEEPEST GOLD MINE IN THE WORLD.—The great exemplar of quartz mining, not only for wealth or production, but as shedding more light upon the real nature and condition of quartz mining than most others, seems to be that of Mr. A. Hayward, at Sutter Creek, Amadar county. His mine is 1200 feet perpendicular descent from the surface, probably 300 feet below the ocean. It is by far the deepest gold mine in the world, and also the most productive. Yet the conditions of its yield are such as to indicate that its powers are barely developed, that it settles the question of deep mining, and that the wealth of gold contained in that mountainous ridge is far beyond the wildest dreams of the most sanguine Californian hitherto. Mr. Hayward, a lawer by education, having had some experience in the lead mines of the Upper Mississippi, pushed across the Plains early in the gold excitement, and reached California in 1850. After much exploration, his attention was fixed at Sutter Creek, Amadar county, in 1853. A mine had been commenced which satisfied the conditions that his sagacity and experience had laid down. He became interested one-fifth, and went to work with that indomitable will and perseverance which, like faith move mountains. The vein was but $8 to $10 rock, but broad, and with difficulty was worked, at a time when flour was $60 per barrel, wages in proportion, and living very high. With these high expenses and poor rock he struggled on for years. In 1857 he was heavily in debt, but, having bought out all the partners, he had become sole proprietor. While he had carried on this desperate struggle, many around him dropped out of the race. They had been frozen out, and were forced to abandon their shafts, overwhelmed with debt. Mr. Hayward was not to be baulked. He had not spent a dollar uselessly, and he observed that the ore improved as the shaft grew deeper. The vein was broad, so that in following it down the shaft formed itself. Not a shovelful was taken out that was not reduced. The east wall of granite went down nearly perpendicular, and that was closely followed. At some hundred feet in depth the ore paid from $12 to $15. The expenses being kept within the closest limits, this began to pay, and each succeeding year it has given greater results, until at the depth of 1200 feet the ore averages $25, with a breadth of 22 feet, and widening as it leaves the shaft in both directions, north and south. At this depth the present writer picked out samples of ore from masses of probably $50 rock. The smooth granite wall rises nearly perpendicular 1200 feet to the surface, and the timbering is done between the walls. The logs are hauled some six miles, at a cost of $6 each. The gallery runs north and south along this wall. The 1000 feet level is some 5000 feet in length, communicating with three shafts, giving perfect ventilation; from this the ore has been mostly removed. The lower level is some 40 feet long, and at either end is the beautiful quartz, with its blue and white vetrical ribbons glittering with the metals. At this depth the value of the ore at the north end improves faster than that of the south end—rather reversing the process above. Some of the ore here is $40 to $50, and some ranges probably to nearly a hundred. The ore above in the galleries, and that here in sight, is equal to three years run (say) $2,000,000. Into this depth drop iron buckets, suspended by strong ropes of continous length, manufactured at the San Francisco works. These ropes, passing over swifters at the top, wind over drums worked by a 100-horse engine, of the most approved pattern for service. This operates night and day. Three sets of hands relieve each other every eight hours below, and 60 tons per day are sent to the surface, dumped into a rail car, which descends by its own weight to the mill, a short distance on Sutter Creek, so named from the fact that Sutter once mined there. The mill runs 40 stamps of 450 lbs. each, at a speed of 80 strokes per minute. The rapid trituration of ore and sulphates is found much more effective than the slower strokes of heavier stamps. The mill is driven by water in the wet season. This is brought by a flume from a very substantial dam above; a powerful engine is also at hand, and at this season, when water runs low, it assists the water-wheel, gradually increasing in power until, later, the water is taken off altogether and reserved for washing. The "clean up," every fourteen days, varies slightly in results, the tendency being always to increase. The ore is not selected, but always that is taken which most facilitates the operations of the miners. No day's work is thrown away, and no stroke of the pick made that does not tend directly to the main point of getting ore. This is the secret of success. From this mine, which has been worked for the last thirteen years by Mr. Hayward—himself a most experienced and skilful operator in every branch of the business—assisted by three able men (Messrs. Hazelhurst, Morgan, and Hunter), there has been extracted probably six to seven millions of dollars. This is a great fact; but, what is more important to the public, a still greater fact presents itself—*that quartz veins increase in width and value in proportion to depth.* The mine in question shows a true fissure—an injection of gold-bearing quartz from below, and which tapers off in size and value as it approaches the surface. Following it down a distance of 1200 feet has demonstrated this fact. There are no other mines that approach this in depth. The Eureka Mine, in Grass Valley, is 300 feet down, but is of richer rock than was the Sutter Creek Mine at that depth. The ore is of the same appearance in both. Considering all these circumstances, the public will have to look forward to a gold production in this State of a magnitude compared to which all that has gone before is as nothing.—*Alta California.*

## HINTS TO EMIGRANTS—No. VII.

BY CHARLES S. RICHARDSON.

It will be perceived in my enumeration of the rate of wages, prices of merchandise, &c., that I have reduced dollars and cents into pounds and shillings. I have done this for the convenience of those who do not know their relative values. This will do very well if the money is to be spent in the country, but inapplicable to foreign purchases, or where the money is to be sent home; because gold here is at a premium of 40 per cent.—or, more properly speaking, American currency is 28¼ discount when bank notes are at par (now commonly called "green backs"). $4·84 is of equivalent value to 1*l.* sterling; at 40 per cent. premium on gold it takes $6·77 to purchase a sovereign. The price is continually fluctuating. Since the war gold has ranged from 28 to 49 prem., and although it does not materially affect things here, yet it becomes very annoying to foreign commerce. Gold and silver coin is not used here at all in domestic trading. We have a Government fractional currency of various denominations, from 2½d. to 2s.—viz., 5 cents to 50 cents; and notes from $1 to $100. It answers all the purposes of trade, but if you want to convert it into gold you must submit to the discount above named, which varies from 20 to 34 per cent.

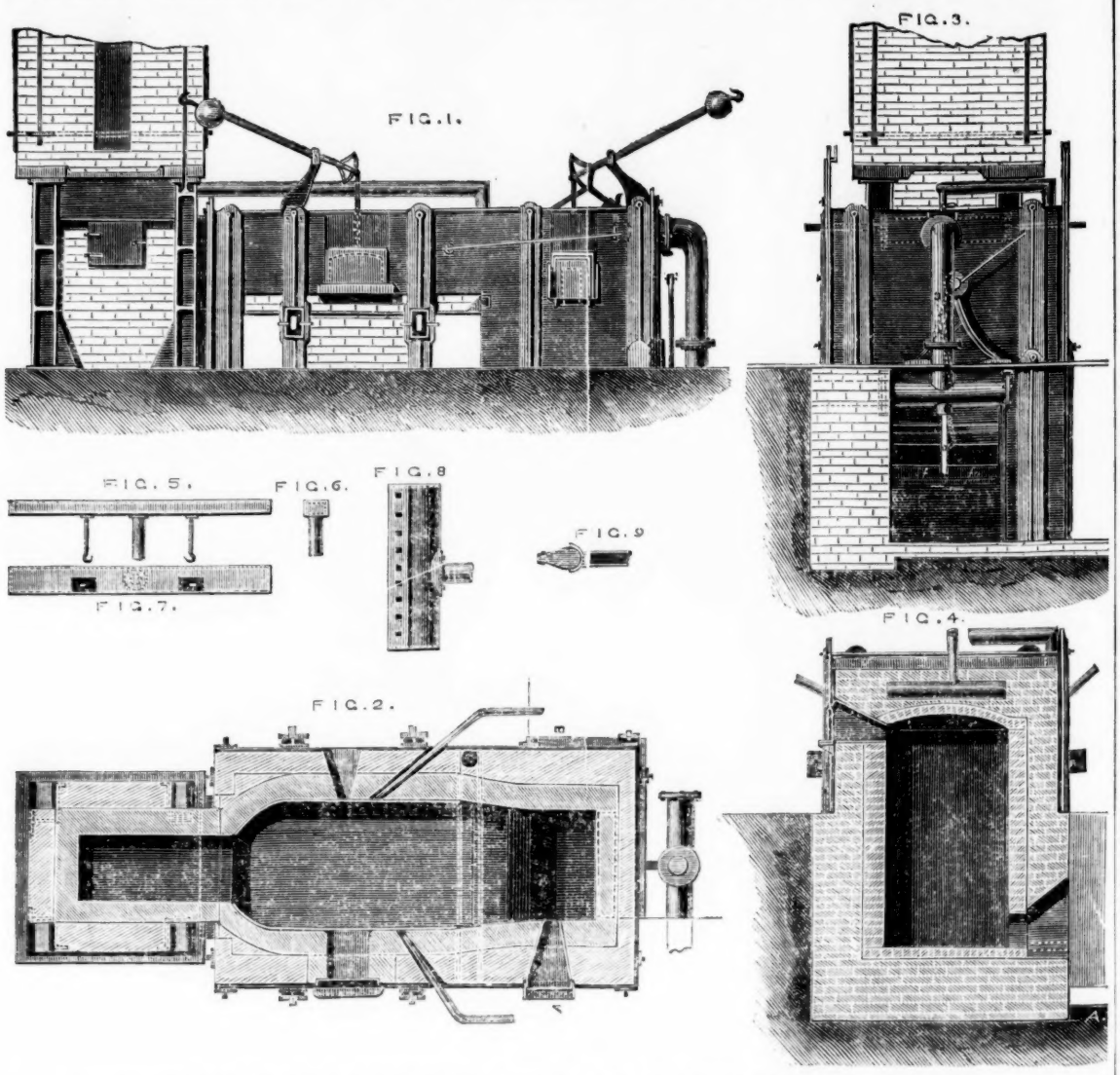
I will now proceed to inform you what will be the product of your labour, and how to employ that labour to produce it, after which you will have a pretty general idea of the difficulties before you, and the attendant results. I will suppose you have either purchased outright or on time some 200 acres of these unimproved lands, which you can always do either way, at from 1*l.* to 1*l.* 10s. per acre. You have first to build your house, which is usually of rough-hewn logs; then fence your first inclosure, which must not be less than 10 acres, being about enough to provide your family with bread and vegetables for the year. You must have some hogs, a cow, geese, and fowls, and a horse. The latter you will have to feed, all the others get their own living in the woods; and if it is a good "mask season"—plenty of acorns, hickory nuts, beech masks, white walnuts, &c.—they will keep in good condition, and be almost fat at the close of autumn; the pigs only requiring to be penned up a few weeks to render them fit for the market or family consumption. For the first two or three years, beyond a few potatoes, butter, and chickens, you will have little to sell, for the farm, in this way of working, is only sufficient to find food for your household. During the winter, which is very short, you must either go to work for wages, or be cutting timber, making staves, shingles, or hoop poles on your own land, and getting them down to the Kanawha or Ohio rivers for sale. You will also clear and fence in another 10 or 15 acres of ground: 2 or 3 acres of this should be put into tobacco; and if you cannot attend to all of it yourself, go shares with one of your neighbours. One man and a boy will attend to 4 acres, except during the planting, worming, and curing season, when some additional help will be required. In Roane and Calhoun counties, which possess some of the finest tobacco lands in the State, the average crop, when properly cultivated, is 600 lbs. per acre, now worth at Parkersburg or Charleston 9d. per lb., making the produce from each acre worth 21*l.* 13s. 4d. The poorest of these lands produce the best tobacco, but the rich land the greatest quantity. Now, tobacco is a very exhaustive crop, and should never be repeated more than two consecutive seasons, or it will impoverish the land, so as to render it unfit for the production of cereals for years afterwards. When all the marketable timber trees have been cut and removed, the remainder is "girdled"—viz., a deep incision is made all around the standing trees, and the next summer they die. The underbrush and saplings are next grubbed up, placed in heaps, and when dry are fired. A coulter-rutter, or deep shovel plough, is then set to work, and the ground broken up and harrowed. The tobacco is planted as soon as the night frosts will permit; and when the plants have taken root, and become strong enough to allow the ground to be agitated, a three-fanged cultivator, or bull-tonged plough, is run between the rows, and the weeds kept clear by the hoe. Unless the ground is very rough, twice ploughing is sufficient. Next comes the worming, about July: this is an important season. The plants are beset by a large caterpillar, which buries itself in the ground during the day, and comes out in the evening. This insect grows very fast. I have known one to become 3 in. long in a week. It is very destructive, and if not picked off when young will entirely destroy all the best leaves of the plant. Children are now employed, early in the morning and at evening, to pick them off. In about a month the worm ceases to breed, when the plants do not require such close attention. The tobacco worm is a singular insect, but when its habits are once known the mischief it would otherwise do is easily prevented. Nothing more is now required until the cutting and curing season—the harvest—which I will fully explain at some future time in an article on tobacco cultivation. From this short description you will perceive that the greatest portion of the work, so far as time is concerned, is done by boys and girls, and shows that by industry and attention two acres of ground put in tobacco will procure enough money to provide the entire family with clothing and groceries for a year; and not only that, but the ground is now in excellent condition for corn, or any other agricultural produce.

SORGHUM.—This is a kind of sugar-cane, recently introduced into this country, and is now cultivated by every farmer in these north-western States. It is very productive. There are two kinds—the Impie, or African, and the Chinese variety. The former produces the largest quantity of juice, and the latter the most sugar, or, in other words, contains the larger quantity of sacharine matter. It is planted in the same way as maize, or Indian corn, and requires about the same amount of attendance. On my land in Kanawha I have produced at the rate of 250 gallons of mollases to the acre from the Chinese and 325 gallons from the Impie canes. On bottom lands it grows 12 ft. high, but does not ripen so quickly as that grown on the uplands. It should always be planted early, for if the frost takes it before being harvested the juice is very apt to turn sour. Sorghum molasses is now used for many purposes, and takes the place of sugar. With suitable apparatus, it can be converted into sugar of a very fine quality; but as there is a good deal of difficulty in effecting its crystallisation, the farmers only use it in the form of syrup. It is of a much finer flavour, and, I think, much preferable to the New Orleans sugar-cane molasses. It sells in the towns for about 2s. 6d. per gallon.

MAPLE SUGAR.—All the woods abound in the sugar maple tree. A good tree will produce 3 lbs. of sugar during the season. The sap begins to rise in February, or immediately the sun has power enough to warm the top branches of the trees. Then the men and the boys go out into the woods where the maples are thick, and construct a rude shed, and cover it with chesnut bark. Across that is a beam, on which they hang two iron kettles, of about 10 or 15 gallons capacity. This is called the "Sugar Camp." They next bore holes into the back of the trees, and insert a tube made of elder, with the pith extracted, and place under it wooden troughs, or tin pans, into which the sap juice of the tree runs. The boys now go from tree to tree, with a barrel drawn on a sleigh by a horse or ox, who collect it, and take it to the camp, where the women or girls boil it down into syrup or sugar, as they may desire. The sugar has a close-grained crystal, and it will take on an average about 18 gallons of sap juice to make 1 lb. of sugar. This may be considered a very tedious operation, and so it is; but remember you came out here to work, and "no work no sugar." But it is the work of the women and children, the men having little or nothing to do with it, therefore does not engross any of his time. It is a very comfortable thing to have a barrel of maple syrup in the house, besides sugar. I know of several families who make over 200 lbs. a-year. It sells also at a very good price in the towns, being used as a candy, and worth 1s. 6d. per lb. in the cake.
—*Pine-street, New York.*

ARTIFICIAL TANNIN FROM COAL.—The formation of a substance resembling artificial tannin from coal has been investigated by Mr. William Skey, analyst to the Geological Survey of New Zealand, who has communicated the following results to the *Chemical News*:—When either bituminous coal or lignite is heated with nitric acid for some considerable time, and then the whole evaporated to dryness, a dark brown substance is left, a large portion of which is soluble in water, and the more readily when heated with it. The substance thus dissolved by the water has a bitter and somewhat astringent taste, and it readily precipitates gelatine and albumen from their aqueous solution. Both the soluble and insoluble portions are readily soluble in alcohol and ether, in caustic or carbonated alkali, and also in concentrated sulphuric acid, forming therewith a dark red solution, and from which the part insoluble in water is re-precipitated by dilution; and, further, they appear to contain the elements of nitric acid, as manifested by chemical tests, and by their behaviour on ignition, their combustion being very rapid and complete, accompanied with a slight explosion. These reactions would seem to indicate that by the action of nitric acid upon coal substances are produced analogous to the artificial tannin and picric acid obtained by the action of the same acid upon resin, and, therefore, distinct from the humic acid series of compounds produced from coal by the application of alkaline agents, with which, I apprehend, they have been confounded. If, therefore, artificial tannin should ever be used in the manufacture of leather as a substitute for natural tannin, as existing in barks, &c., in lignite, which best admits of the operation above described (by reason of its permeability to liquids), an abundant source of this material is open to us.

# THE SILESIAN GAS REVERBERATORY FURNACE.




The comparative scarcity of fuel, and its inferior quality, in some parts of Germany, have led to careful experiments with the view of economising it in the manufacture of iron. The result has been that a system of gas reverberatory furnaces is now, and has for some years past, been in use in Germany and other parts of the Continent. The most simple and efficient form is known as ECK'S furnace, which is employed at the Government Smelting Works at Gleiwitz and Konigshutte, in Upper Silesia. The furnace is represented in the accompanying engraving, where Fig. 1 is a side elevation, Fig. 2 a sectional plan, Fig. 3 an end elevation, Fig. 4 a cross section at A B in Fig. 2, and Figs. 5 to 9 are details. The gas generator (which replaces the fire-place of the ordinary reverberatory furnace) is an oblong chamber, 3 ft. 9 in. wide and 6 ft. 4 in. high, from the sole to the commencement of the sloping bridge. It tapers slightly towards the top, so as to facilitate the descent of the fuel, which is introduced through a lateral opening near the top of the generator. Its cubical contents are about 44 ft.

The air necessary for the production of the gas is supplied by a feeble blast, and enters the generator from the two openings or tuyeres of a long air-chest of iron plate (Figs. 5, 6, and 7) fixed at the back of the chamber, near the bottom. The space between the air-chest and the sole of the chamber serves as a receptacle for the slag and ash from the fuel. There are openings in the other side of the chamber, opposite the tuyeres, which are generally closed by iron plugs, but are required when the tuyeres have to be cleaned out. There is an opening below the air-chest, through which fire is introduced into the chamber when the furnace is set at work, and which is then bricked up, until, at the expiration of about fourteen days, it becomes necessary to let the fire die out, when the slag and ashes accumulated on the sole of the chamber are removed through this opening.

The hearth of the furnace is constructed of a somewhat loamy sand, this material being best adapted to withstand the high temperature obtained in this furnace. Its general thickness is about 6 in.; its form is that of a shallow dish, with a slight incline towards the tap-hole. A rapid circulation of cold air below the fire-bridge and the plate of the hearth is provided for; if this were not the case the iron would soon penetrate through the hearth. Figs. 8 and 9 represent the upper oblong air-chest, provided with a series of tuyeres, which enter the top of the furnace just over the fire-bridge, at an angle of 30°. The air forced into the furnace through these tuyeres serves to inflame and burn the gases rushing out of the generator, and the direction of the blast throws the resulting flame down upon the metal on the hearth, in front of the bridge. This air-chest communicates, like the other one, by pipes with the air-accumulator of the neighbouring blast-furnace. The amount of pressure employed is about 4 lbs.; but the supply of air, both to the generator and the inflammable gases, admits of accurate regulation by means of valves in the connecting pipes. There is an opening in the arch at both sides of the furnace, not far from the bridge, into which, at a certain stage of the operation, tuyeres are introduced (being placed at an angle of 25°), also connected with the blast-apparatus, and provided with regulating valves.

From Prof. ABEL'S report on these furnaces we learn that the refining process is carried out in the following manner:—The hearth of the furnace having been constructed or repaired, a brisk coal fire is kindled in the generator, through the opening at the bottom, which is afterwards bricked up. About 20 cubic feet of coals are then introduced from above, and the necessary supply of air admitted to the generator, through the lower air-chest. When these coals have been thoroughly ignited, the generator is filled with coals, and a very moderate supply of air admitted through the tuyeres below (for the generation of the gas) and those over the bridge (for its combustion), until the furnace is dried, when the supply of air at both places is increased, so as to raise the hearth to the temperature necessary for baking it thoroughly. The hearth frequently settles in places when first the furnace is set at work, and will sometimes require patching after a batch of metal is tapped, until six or seven charges have been worked, when it becomes perfectly hard and even. When the hearth is well baked, about 40 cwts. of iron is introduced, the metal being distributed over the whole hearth as uniformly as possible, and the size of the pieces being selected with the view to expose as much surface as possible to the flame.

The fusion of the charge of metal is effected in about three hours, and the coal used for that purpose at Konigshutte (which is of inferior quality) amounts to about 3¾ cubic feet per hour. The gas-generator is always kept filled with coal, and the supply of air admitted from below is diminished, by a regulation of the valve, whenever fresh coal is supplied, as the latter, at first, always yields gas more freely. After a little experience with the particular description of coal used, not a particle of the fuel is wasted, as the amount of air admitted into the generator below is only sufficient to supply the heat necessary for the generation of the coal gas, and, as the result of that production of heat, to furnish (inflammable) carbonic oxide gas from the coke, as it gradually descends in the generator, and is replaced in the upper part by fresh coal. The arrangement of the upper row of tuyeres effect the combustion of gases just as they pass from the generator to the hearth: and here, again, the supply of air can be so nicely regulated that the resulting flame is made to play over the whole hearth, while none is allowed to escape into the flue. The hottest portion of the furnace is, of course, near the fire-bridge—*i. e.*, where the blast first meets with the gases. During the melting process the iron is shifted occasionally, so that the cooler portion, near the flue, may, in its turn, become melted, without loss of time. When the iron is ascertained to be thoroughly fused, about 5 lbs. of crushed limestone are thrown over its surface, for the purpose of converting the dross which has separated into fusible slag.

The two side tuyeres are now introduced into the furnaces through the openings above alluded to, the width of the nozzle employed depending upon the power of the blast used. The air rushing from these tuyeres impinges with violence upon the iron, and, the two currents meeting, an eddying motion is imparted to the fused metal. In a short time the motion produced in the mass is considerable; the supernatant slag is blown aside by the blast, and the surface of iron thus exposed undergoes refinement, while it changes continually, the temperature of the whole mass being raised to a full white heat by the action of the air. The iron is also stirred occasionally, in order to ensure a proper change in the metal exposed to the action of the blast. A shovelful of limestone is occasionally thrown in (the total quantity used being about 1 per cent. of the crude iron employed). The slag produced is exceedingly fusible, and is allowed to remain in the furnace until the metal is tapped, as it interferes in no way with the refining process. It is run off at last with the metal, from which it separates completely upon cooling.

The duration of the treatment in this furnace, after the metal is fused, varies from two hours and a-half to five hours, according to the product to be obtained. About three hours' treatment would, most probably, suffice for the production of the particular description of iron adapted for cannon from grey pig-iron, to judge from the specimens of the products exhibited at Konigshutte. For the preparation of perfectly white iron, the treatment is carried on for five hours. A sample is tapped, to examine its appearance, when it is believed to be sufficiently treated. When the charge is to be withdrawn from the furnace, the side tuyere, nearest the tap-hole, is withdrawn, so that the blast from the opposite tuyere may force the metal towards the hole. The fluid iron, as its flows from the tap-hole, is fully white-hot, and perfectly limpid; it chills, however, very rapidly, and soon solidifies. A few pails of water are thrown upon those portions of the metal which are not covered with the slag which flows out of the furnace, the object being to cool it rapidly, and thus prevent the oxidation of any quantity of iron. The loss of metal during the treatment is said not to exceed 5 per cent. The gas reverberatory furnace may be employed with or without the two lateral tuyeres; these are introduced when it is to be used as a refinery furnace; but, under any circumstances, their judicious employment must facilitate the rapid mixture and purification of the metal, the objects to be attained in the re-melting of iron for the manufacture of ordnance.—*Mechanics' Magazine.*

STEAM TURBINES.—It is a well-known fact that the travelling speed with which a fluid body emanates from a vessel depends on the pressure which is brought to bear upon it; steam, therefore, travels with a speed proportionate to its pressure in the boiler. It is also well known that a body in motion exercises a power on another body which may happen to oppose its progress, and that this power increases in a certain proportion as the motion of such body increases in speed. If steam, therefore, at its point of emanation be opposed in its progress by a moveable object, such object will be forced out of its place, with a power proportionate to the travelling speed of the steam; and if buckets on the circumference of a revolving wheel constitute the object thus opposed, the motion of the steam will be transferred to the said wheel, and a continuous rotary motion produced, capable of being transmitted to other machinery. Taking advantage of these facts, Mr. CARL WENNER, C.E., of Horwich, near Bolton-le-Moor, has constructed a machine, where the laws regulating these facts have been brought to bear. Two wheels are placed concentrically, the one immediately above the other, each provided with buckets, to form the steam passages. These said wheels are placed inside a cylindrical casing, in such a manner that the upper one is fixed to this said casing, whilst the lower one is left free to revolve on its axis, which is made to protrude to the outside of the said casing, to allow wheels, straps, or friction rollers for transmitting its motion. A suitable packing is provided between the revolving wheel and the casing, to prevent the steam from escaping. The steam when let into the machine passes, first into the upper one of the said two wheels, where it receives its direction, and from thence on to the lower wheel, to which it transfers its motion in acting by means of its impetus on buckets of the said wheel, and then passes off, either into the open air, or into an exhauster, as may be deemed proper.

COMPRESSION OF AIR APPLIED TO THE WORKING OF MINES.—The facility with which any invention or adaptation fitted to lessen the labour or to overcome obstacles in the working of mines is brought into common use, is the best proof of how keenly every resource to lessen the large cost attending such industry is looked to. Not the least important of such endeavours has just been brought to a most successful termination by Messrs Bull, Sharp, and Errington, three gentlemen long connected with the practice of mechanical engineering in the Ballarat district, who, if not the originators of the invention, are at least the first in the colony to introduce it in a practical manner. We allude to the pneumatic engine, for which these gentlemen have taken out a patent extending protection to them throughout the Australian colonies and New Zealand. Before finally bringing it before the public, however, they determine to demonstrate the feasibility of applying compressed air for driving an engine doing ordinary mine work, and after some negociations came to terms with the Ballarat Tunnel Company to put up a pumping-engine 3000 ft. in from the mouth of their adit tunnel, to drain the gutter workings, situated about 40 ft. deeper. The whole of the works necessary were to be put up at the patentees' cost, the company on its part undertaking to pay a weekly rental for the same, should it prove a successful experiment. This has been the case, to the general delight of the three engineers, the company generally, and the men employed. To fully understand the nature of the work accomplished, it will be necessary to give a slight account of the state in which the mine was when the agreement was entered into. The works mainly consist of an adit tunnel, 3000 ft. long; an incline from the end of this down to the gutter workings, 300 ft. long; and a blind shaft, containing pumps 4 in. in diameter, reaching from the upper to the lower level, and further deepened, so as altogether to be 60 ft. Near the top of the incline and pump shaft was hollowed out a large chamber, in which was a horse-whim for working the said pumps and drawing the trucks up the incline. The other parts of the mine consist of numerous drives in wash-dirt, prospecting drives, rises, air drives, &c., which it is unnecessary for the present purpose to describe more fully. Suffice it to say, that after working for some time with horses the water became too heavy, and a patent hydraulic pump was procured, which, however, proved unequal to the emergency, and the mine was finally flooded out early in June, the water rising from the lower to the upper workings in 96 hours, and running out in a stream at the tunnel mouth. Under these circumstances, after having matured their working plans on paper, the patentees signed the agreement with the company, and also specifications for the construction of the machinery—thus taking all the risk of failure to themselves, without having any one of them seen a machine of the kind in existence, though, of course, thoroughly up in the theory of the matter through the many descriptions given, the diagrams illustrating the adaptation of compressed air for producing motion in the tunnel of Mont Cenis, and still more recently in general use in the home country. Outside the tunnel there is a fine 14-in. steam-engine, heretofore used for driving two puddling machines. To an ordinary pump crank on the first motion of this engine is fitted the machinery for compressing the air, which is conveyed along 3000 ft. of 2-in. iron pipes to another ordinary engine, which has taken the place of the underground whim. These 2-in. pipes act just in the same manner as the steam-pipe from a boiler does to an ordinary steam-engine, the only difference being that instead of conveying steam in a state of compression, they convey atmospheric air in a state of compression, therefore the underground engine is no longer a steam-engine but an air-engine, or, as its inventors designate it, a pneumatic engine. This compression is accomplished at the outside engine by means of an air-pump in the form of a cylinder, in which a piston and valves act as in an ordinary air-machine, as used in several of our large mines, including the Band of Hope and Albion Companies. The principle is the same as in the common hydraulic press, or any common force-pump, but the air-machine is the nearest approach to it, and will most readily convey an idea of the mode of working. Two circular valves, about 4 in. in diameter, admit the air alternately at each end of the cylinder; by the stroke of the piston it is next forced through other two valves into a breeching pipe, the piston working on a 3½-ft. stroke, and at the rate of about 28 strokes per minute. To the top of this breech-pipe is fixed the service pipe to the pumping-engine, 3000 ft. within the bowels of the earth. To reduce as much as possible the great heat engendered by the compressing process, the air cylinder is kept immersed in a bath supplied with a small stream of running water, notwithstanding which the first hundred or two feet of the pipes are nearly as hot as steam-pipes, but by the time it reaches the chamber the air blows off perfectly cold, acts as an agreeable fan to the traveller, heated with the tramp through the workings, and keeps the mine ventilated to a degree of perfection that perfectly astonishes the men who formerly worked in the same spot, three-parts suffocated with impure air, mixed with all the disagreeable exhalations so unavoidable where a number of horses are working underground. Before ventilating the mine, however, the air has other work to do; and, after passing a safety-valve loaded to about 40 lbs. on the square inch, it passes directly into the valves of the engine, and there palpitates, and puffs, and screams, and heaves at its work like its elder brother at the same business—steam. The engine worked by air is a compact 8½-in. cylinder, 16-in. stroke, by Tennant, and works smoothly, the new 8-in. double-action pump throwing up from 100 to 120 gallons of water per minute. No boiler, smoke, fire, nor steam pollutes the air; the mouth of the escape-pipe vomits forth only icy cold blasts of air, and the moisture escaping with the compressed air actually forms itself into ice about the edges of the pipe, on which the engine-driver coolly rests his disengaged hand while he works the handles with the other, the atmosphere being as clear as could be desired. Happy prospects for our pale-faced miners, and for beleaguered call-paying shareholders, whom bad air has too long deprived of their dividends! The safety-valve blows off air like a whale, and when entirely lifted the engine was caused to stop for a few moments, but in the beat of a bar of music after it was closed again the engine again began to move, and proved how perfectly the motive power was under control. To show what the 2-in. air-pipe has done, after the failure of eight or nine horses in the whim and the discarded patent pump to boot, it is only necessary to say that the lower workings were drained by the new machinery in two and a-half days after it was started, the flooded mine having included the whole of the 300 ft. Incline drive (size 5½ ft. cap piece between the props, 7 ft. at base), 600 ft. of double drive, pump shaft, blocked-out spaces, and numerous smaller drives. The pumping was done at great disadvantage, owing to the sludge getting into the windbore, and all the water came up in a very thick state. The pumps were first of all started on Saturday night, and on Wednesday morning the water was down to fork 20 ft. below the level of the workings, and as soon as the winding-gear is fixed to the engine the business of clearing drives will commence. The whole experiment is so satisfactory and so complete that it will quickly excite attention from all those who are on the look-out for similar deliverence from mining evils, and will cheapen cost, besides contributing to the health of all those companies requiring underground power. A number of gentlemen from Ballarat visited the claim yesterday, including four directors of the company, two of the patentees, our mining reporter, and others, to all of whom, including the mining manager and the working men of the claim, it has been a matter of surprise that so much has been accomplished in so short a time, and the spot will doubtless offer attraction to many others who wish to be convinced of the efficacy of a scheme that has been most praiseworthily matured by the three gentlemen already named, under heavy discouragement and some ridicule. We may add that the compressing machine was manufactured at the Soho Foundry, and that the patentees are turning their attention to other adaptations of the same power, including the production of a locomotive engine to supersede, if possible, the use of horses in drives, and of a driving machine to work in quartz veins. We wish them every success.—*Ballarat Star.*

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